

§ 86.1333

40 CFR Ch. I (7–1–14 Edition)

certify up to 5 percent of your nationwide sales volume of engines certified under subpart A of this part in a given model year based on this E0 test fuel if those engines are certified with carry-over data.

(f) You may use special or alternate procedures to the extent we allow them under 40 CFR 1065.10. In addition, for 2010 and earlier model year engines, you may use modified test procedures as needed to conform to the procedures that were specified at the time of emission testing for the model year in question.

(g) This subpart applies to you as a manufacturer, and to anyone who does testing for you.

(h) For testing conducted with engines installed in vehicles, including field testing conducted to measure

emissions under Not-To-Exceed test procedures, use the test procedures and equipment specified in 40 CFR part 1065, subpart J.

[79 FR 23703, Apr. 28, 2014]

§ 86.1333 Transient test cycle generation.

(a) *Generating transient test cycles.* The heavy-duty transient engine cycles for Otto-cycle and diesel engines are listed in appendix I(f) (1), (2) and (3)) to this part. These second-by-second listings represent torque and rpm maneuvers characteristic of heavy-duty engines. Both rpm and torque are normalized (expressed as a percentage of maximum) in these listings.

(1) To unnormalize rpm, use the following equations:

(i) For diesel engines:

$$\text{Actual rpm} = \frac{\% \text{rpm} \cdot (\text{Max Test Speed} - \text{Curb Idle Speed})}{112} + \text{Curb Idle Speed}$$

Where:

Max Test Speed = the maximum test speed as calculated in 40 CFR part 1065.

(ii) For Otto-cycle engines:

$$\text{Actual rpm} = \frac{\% \text{rpm} \cdot (\text{Max Test Speed} - \text{Curb Idle Speed})}{100} + \text{Curb Idle Speed}$$

Where:

Max Test Speed = the maximum test speed as calculated in 40 CFR part 1065.

(2) Torque is normalized to the maximum torque at the rpm listed with it. Therefore, to unnormalize the torque values in the cycle, the maximum torque curve for the engine in question must be used. The generation of the

maximum torque curve is described in 40 CFR part 1065.

(b) *Example of the unnormalization procedure.* Unnormalize the following test point, given Maximum Test speed = 3800 rpm and Curb Idle Speed = 600 rpm.

PercentRPM	PercentTorque
43	82

(1) Calculate actual rpm:

$$\text{Actualrpm} = \frac{43 \cdot (3800 - 600)}{112} + 600 = 1,829 \text{rpm}$$

(2) Determine actual torque: Determine the maximum observed torque at 1829 rpm from the maximum torque curve. Then multiply this value (e.g.,

358 ft-lbs) by 0.82. This results in an actual torque of 294 ft-lbs.

(c) *Clutch operation.* Manual transmission engines may be tested with a

clutch. If used, the clutch shall be disengaged at all zero percent speeds, zero percent torque points, but may be engaged up to two points preceding a non-zero point, and may be engaged for time segments with zero percent speed and torque points of durations less than four seconds.

(d) Determine idle speeds as specified in 40 CFR 1065.510.

[70 FR 40438, July 13, 2005, as amended at 73 FR 37192, June 30, 2008; 79 FR 23704, Apr. 28, 2014]

§ 86.1360 Supplemental emission test; test cycle and procedures.

The test procedures of this subpart N apply for supplemental emission testing, except as specified otherwise in this section.

(a) *Applicability.* This section applies to 2007 and later diesel heavy duty engines.

(b) *Test cycle.* (1) Perform testing as described in § 86.1362 for determining whether an engine meets the applicable standards when measured over the supplemental emission test.

(2) For engines not certified to a NO_x standard or FEL less than 1.5 g/bhp-hr, EPA may select, and require the manufacturer to conduct the test using, up to three discrete test points within the control area defined in paragraph (d) of this section. EPA will notify the manufacturer of these supplemental test points in writing in a timely manner before the test. Emission sampling for these discrete test modes must include all regulated pollutants except particulate matter.

(3) For engines certified using the ramped-modal cycle specified in § 86.1362, perform the three discrete test points described in paragraph (b)(2) of this section as follows:

(i) Allow the engine to idle as needed to complete equipment checks following the supplemental emission test described in this section, then operate the engine over the three additional discrete test points.

(ii) Validate the additional discrete test points as a composite test separate

from the supplemental emission test, but in the same manner.

(iii) Use the emission data collected during the time interval from 35 to 5 seconds before the end of each mode (excluding transitions) to perform the MAEL calculations in paragraph (f) of this section.

(c) The engine speeds A, B and C, referenced in the table in paragraph (b)(1) of this section, must be determined as follows:

Speed A = $n_{lo} + 0.25 \times (n_{hi} - n_{lo})$

Speed B = $n_{lo} + 0.50 \times (n_{hi} - n_{lo})$

Speed C = $n_{lo} + 0.75 \times (n_{hi} - n_{lo})$

Where: n_{hi} = High speed as determined by calculating 70% of the maximum power. The highest engine speed where this power value occurs on the power curve is defined as n_{hi} .

n_{lo} = Low speed as determined by calculating 50% of the maximum power. The lowest engine speed where this power value occurs on the power curve is defined as n_{lo} .

Maximum power = the maximum observed power calculated according to the engine mapping procedures defined in 40 CFR 1065.510.

(d) *Determining the control area.* The control area extends from the engine speed A to C, as defined in paragraph (c) of this section, and extends from 25 to 100 percent load.

(e) [Reserved]

(f) *Maximum allowable emission limits.*

(1) For gaseous emissions, the 12 non-idle test point results and the four-point linear interpolation procedure specified in paragraph (g) of this section for intermediate conditions, shall define Maximum Allowable Emission Limits for purposes of § 86.007-11(a)(3) except as modified under paragraph (f)(3) of this section. Each engine shall have its own Maximum Allowable Emission Limits generated from the 12 non-idle supplemental steady state test points from that engine. The control area extends from the 25% to the 75% engine speeds, at engine loads of 25% to 100%, as defined in paragraph (d) of this section. Figure 1 of this paragraph (f)(1) depicts a sample Maximum Allowable Emission Limit curve, for illustration purposes only, as follows: